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PATENT & TRADEMARK OFFICE

Docket No. 8733.120.01
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of: Woo-Sup SHIN	Customer No. 30827
Application No. 09/039,438	Confirmation No. 9576
Filed: March 16, 1998	Art Unit: 1763
For: ETCHING APPARATUS	Examiner: ZERVIGON, Rudy

MS Appeal Brief – Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

SECOND AMENDED APPELLANTS' BRIEF

Sir:

In response to a Final Rejection of all pending claims that was mailed on December 12, 2006, and in support of a "Notice of Appeal" filed March 12, 2007 and a Notice of Non-Compliant Appeal Brief dated August 1, 2008, Appellants hereby submit this Second Amended Appeal Brief.

The fees required under § 1.17(f) and any required petition for extension of time for filing this brief and fees therefore are dealt with in the accompanying TRANSMITTAL OF APPEAL BRIEF.

This brief contains items under the following headings as required by 37 C.F.R. § 41.37(c):

I. Real Party In Interest

II. Related Appeals and Interferences

III. Status of Claims

IV. Status of Amendments

V. Summary of Claimed Subject Matter

VI. Grounds of Rejection to be Reviewed on Appeal

VII. Argument

Claims Appendix

Evidence Appendix

Related Proceedings Appendix

I. REAL PARTY IN INTEREST

The real party in interest for this appeal is: LG.PHILIPS LCD CO., LTD.

II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences that will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

Total Number of Claims in the Application

There are 26 claims pending in the application.

Current Status of Claims

Claims canceled: N/A

Claims withdrawn from consideration but not canceled: N/A

Claims pending: 1-26

Claims allowed: N/A

Claims rejected: 1-26

Claims On Appeal: The claims on appeal are claims 1-26.

IV. STATUS OF AMENDMENTS

The Examiner issued a Final Rejection on December 12, 2006. No amendment has been filed in response to this Final Rejection. Accordingly, the claims enclosed herein as the Claims Appendix reflect the current status of claims 1-26.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The following summary of the claimed subject matter describes independent claim 1. The present invention is directed to an etching apparatus for etching a glass substrate, and more particularly to an etching apparatus for the manufacture of a liquid crystal display (LCD). The etching apparatus includes a first tank 12 including a first etchant. (See Fig. 1 and page 10, lines 8-11). The etching apparatus also includes an etch bath 20 having a bubble plate 27. (See page10, lines 18-20.) The etch bath 20 is connected to the first tank 12 and receives etchant from the first tank 12. During the etching of the glass substrate, the etch bath 20 contains a residual etchant including a diluted etchant and residue material. The residual material includes particles in the glass not affected by the etchant. (See page 12, lines 1-13.) The bubble plate 27 generates nitrogen bubbles to mix the etchant during the etching process, and the bubble plate is connected to a first nitrogen inlet pipe 22 that is connected to a nitrogen supply line 52. (See page 10, lines 18-20) The first tank 12 receives solvent water from a solvent supply source DI.WATER. Also, the first tank 12 receives an undiluted etching solution for the etchant solution tank 11 via the undiluted etchant inlet pipe 16. (See page 11, lines 5-9.)

The etching apparatus also includes a second tank 13 that receives the residual etchant from the etch bath 20 via a connecting passage 23. (See page 16, lines 1-3.) The second tank 13 separates the diluted etchant from the residue material using of the residue material, and the second tank 13 then directly transfers the separated diluted etchant back to the first tank 12 via connecting pipe 17. (See page 11, lines 1-9.) An outlet pipe 18 is attached to the second tank 13 to discharge residual material. (See page 11, lines 7-9, Fig. 1.)

The etching apparatus also includes a control unit CPU to control the operation of the etch bath 20, the rinse bath 30, the dry bath 40, the first tank 12, and the second tank 13. Temperature may be used to determine the amount that the substrate has been etched, and hence the final thickness of the substrate. The temperature of the etchant indicates the total reaction energy of the etching reaction that indicates the amount of the substrate removed. A temperature sensor 60 in the etch bath 20 determines the temperature of the etchant and communicates this temperature to the control unit CPU. For example, when the etchant reaches a predetermined temperature corresponding to a desire substrate thickness, the control unit CPU may stop the etching process. (See page 15, 1-10.)

The following summary of the claimed subject matter describes independent claim 10. The present invention is directed to an etching apparatus for etching a glass substrate, and more particularly to an etching apparatus for the manufacture of a liquid crystal display (LCD). The etching apparatus includes an etch bath 20 having an enchant for etching a a glass substrate. (See page10, lines 18-20

The etching apparatus also includes a control unit CPU to control the operation of the etch bath 20, the rinse bath 30, the dry bath 40, the first tank 12, and the separation tank 13. Temperature may be used to determine the amount that the substrate has been etched, and hence the final thickness of the substrate. The temperature of the etchant indicates the total reaction energy of the etching reaction that indicates the amount of the substrate removed. A temperature sensor 60 in the etch bath 20 determines the temperature of the etchant and communicates this temperature to the control unit CPU. For example, when the etchant reaches a predetermined temperature corresponding to a desire substrate thickness, the control unit CPU may stop the etching process. (See page 15, 1-10.)

The following summary of the claimed subject matter describes independent claims 11. The present invention is directed to an etching apparatus for etching a glass substrate, and more particularly to an etching apparatus for the manufacture of a liquid crystal display (LCD). The etching apparatus includes a first tank 12 including a first etchant. (See Fig. 1 and page 10, lines 8-11). The etching apparatus also includes an etch bath 20 having a bubble plate 27. (See page10, lines 18-20.) The etch bath 20 is connected to the first tank 12 and receives etchant from the first tank 12. During the etching of the glass substrate, the etch bath 20 contains a residual etchant including a diluted etchant and residue material. The residual material includes particles in the glass not affected by the etchant. (See page 12, lines 1-13.) The bubble plate 27 generates nitrogen bubbles to mix the etchant during the etching process, and the bubble plate is connected to a first nitrogen inlet pipe 22 that is connected to a nitrogen supply line 52. (See page 10, lines 18-20) The first tank 12 receives solvent water from a solvent supply source DI.WATER. Also, the first tank 12 receives an undiluted etching solution for the etchant solution tank 11 via the undiluted etchant inlet pipe 16. (See page 11, lines 5-9.)

The etching apparatus also includes a separation tank 13 that receives the residual etchant from the etch bath 20 via a connecting passage 23. (See page 16, lines 1-3.) The separation tank

13 separates the diluted etchant from the residue material using of the residue material, and the separation tank 13 then directly transfers the separated diluted etchant back to the first tank 12 via connecting pipe 17. (See page 11, lines 1-9.)

The etching apparatus further includes a rinse bath 30 and a dry bath 40. The rinse bath 30 cleans the glass substrate that is etched in the etch bath 20, and the glass substrate is dried in the dry bath 40 after rinsing. (See page 11, lines 10-11, 18-19.)

The etching apparatus also includes a control unit CPU to control the operation of the etch bath 20, the rinse bath 30, the dry bath 40, the first tank 12, and the separation tank 13. Temperature may be used to determine the amount that the substrate has been etched, and hence the final thickness of the substrate. The temperature of the etchant indicates the total reaction energy of the etching reaction that indicates the amount of the substrate removed. A temperature sensor 60 in the etch bath 20 determines the temperature of the etchant and communicates this temperature to the control unit CPU. For example, when the etchant reaches a predetermined temperature corresponding to a desire substrate thickness, the control unit CPU may stop the etching process. (See page 15, 1-10.)

The following summary of the claimed subject matter describes independent claim 21. The present invention is directed to an etching apparatus for etching a glass substrate, and more particularly to an etching apparatus for the manufacture of a liquid crystal display (LCD). The etching apparatus includes a first tank 12 including a first etchant. (See Fig. 1 and page 10, lines 8-11). The etching apparatus also includes an etch bath 20 having a bubble plate 27. (See page10, lines 18-20.) The etch bath 20 is connected to the first tank 12 and receives etchant from the first tank 12. During the etching of the glass substrate, the etch bath 20 contains a residual etchant including a diluted etchant and residue material. The residual material includes particles in the glass not affected by the etchant. (See page 12, lines 1-13.) The bubble plate 27 generates nitrogen bubbles to mix the etchant during the etching process, and the bubble plate is connected to a first nitrogen inlet pipe 22 that is connected to a nitrogen supply line 52. (See page 10, lines 18-20) The first tank 12 receives solvent water from a solvent supply source DI.WATER. Also, the first tank 12 receives an undiluted etching solution for the etchant solution tank 11 via the undiluted etchant inlet pipe 16. (See page 11, lines 5-9.)

The etching apparatus also includes a second tank 13 that receives the residual etchant

from the etch bath 20 via a connecting passage 23. (See page 16, lines 1-3.) The second tank 13 separates the diluted etchant from the residue material using of the residue material, and the second tank 13 then directly transfers the separated diluted etchant back to the first tank 12 via connecting pipe 17. (See page 11, lines 1-9.) An outlet pipe 18 is attached to the second tank 13 to discharge residual material. (See page 11, lines 7-9, Fig. 1.)

The etching apparatus also includes a control unit CPU to control the operation of the etch bath 20, the rinse bath 30, the dry bath 40, the first tank 12, and the second tank 13. Temperature may be used to determine the amount that the substrate has been etched, and hence the final thickness of the substrate. The temperature of the etchant indicates the total reaction energy of the etching reaction that indicates the amount of the substrate removed. A temperature sensor 60 in the etch bath 20 determines the temperature of the etchant and communicates this temperature to the control unit CPU. For example, when the etchant reaches a predetermined temperature corresponding to a desire substrate thickness, the control unit CPU may stop the etching process. (See page 15, 1-10.)

The following summary of the claimed subject matter describes independent claim 22. The present invention is directed to an etching apparatus for etching a glass substrate, and more particularly to an etching apparatus for the manufacture of a liquid crystal display (LCD). The etching apparatus includes an etch bath 20 having an enchant for etching a a glass substrate. (See page10, lines 18-20

The etching apparatus also includes a control unit CPU to control the operation of the etch bath 20, the rinse bath 30, the dry bath 40, the first tank 12, and the separation tank 13. Temperature may be used to determine the amount that the substrate has been etched, and hence the final thickness of the substrate. The temperature of the etchant indicates the total reaction energy of the etching reaction that indicates the amount of the substrate removed. A temperature sensor 60 installed in the etch bath 20 determines the temperature of the etchant and communicates this temperature to the control unit CPU. For example, when the etchant reaches a predetermined temperature corresponding to a desire substrate thickness, the control unit CPU may stop the etching process. (See page 15, 1-10.)

The following summary of the claimed subject matter describes independent claims 23.

The present invention is directed to an etching apparatus for etching a glass substrate, and more particularly to an etching apparatus for the manufacture of a liquid crystal display (LCD). The etching apparatus includes a first tank 12 including a first etchant. (See Fig. 1 and page 10, lines 8-11). The etching apparatus also includes an etch bath 20 having a bubble plate 27. (See page10, lines 18-20.) The etch bath 20 is connected to the first tank 12 and receives etchant from the first tank 12. During the etching of the glass substrate, the etch bath 20 contains a residual etchant including a diluted etchant and residue material. The residual material includes particles in the glass not affected by the etchant. (See page 12, lines 1-13.) The bubble plate 27 generates nitrogen bubbles to mix the etchant during the etching process, and the bubble plate is connected to a first nitrogen inlet pipe 22 that is connected to a nitrogen supply line 52. (See page 10, lines 18-20) The first tank 12 receives solvent water from a solvent supply source DI.WATER. Also, the first tank 12 receives an undiluted etching solution for the etchant solution tank 11 via the undiluted etchant inlet pipe 16. (See page 11, lines 5-9.)

The etching apparatus also includes a separation tank 13 that receives the residual etchant from the etch bath 20 via a connecting passage 23. (See page 16, lines 1-3.) The separation tank 13 separates the diluted etchant from the residue material using of the residue material, and the separation tank 13 then directly transfers the separated diluted etchant back to the first tank 12 via connecting pipe 17. (See page 11, lines 1-9.) An outlet pipe 23 is attached to the second tank 13 to discharge residual material. (See page 16, lines 1-3, Fig. 1.)

The etching apparatus further includes a rinse bath 30 and a dry bath 40. The rinse bath 30 cleans the glass substrate that is etched in the etch bath 20, and the glass substrate is dried in the dry bath 40 after rinsing. (See page 11, lines 10-11, 18-19.)

The etching apparatus also includes a control unit CPU to control the operation of the etch bath 20, the rinse bath 30, the dry bath 40, the first tank 12, and the separation tank 13. Temperature may be used to determine the amount that the substrate has been etched, and hence the final thickness of the substrate. The temperature of the etchant indicates the total reaction energy of the etching reaction that indicates the amount of the substrate removed. A temperature sensor 60 in the etch bath 20 determines the temperature of the etchant and communicates this temperature to the control unit CPU. For example, when the etchant reaches a predetermined temperature corresponding to a desire substrate thickness, the control unit CPU may stop the etching process. (See page 15, 1-10.)

The following summary of the claimed subject matter describes independent claim 26. The present invention is directed to an etching apparatus for etching a glass substrate, and more particularly to an etching apparatus for the manufacture of a liquid crystal display (LCD). The etching apparatus includes a first tank 12 including a first etchant. (See Fig. 1 and page 10, lines 8-11). The etching apparatus also includes an etch bath 20 having a bubble plate 27. (See page10, lines 18-20.) The etch bath 20 is connected to the first tank 12 and receives etchant from the first tank 12. During the etching of the glass substrate, the etch bath 20 contains a residual etchant including a diluted etchant and residue material. The residual material includes particles in the glass not affected by the etchant. (See page 12, lines 1-13.) The bubble plate 27 generates nitrogen bubbles to mix the etchant during the etching process, and the bubble plate is connected to a first nitrogen inlet pipe 22 that is connected to a nitrogen supply line 52. (See page 10, lines 18-20) The first tank 12 receives solvent water from a solvent supply source DI.WATER. Also, the first tank 12 receives an undiluted etching solution for the etchant solution tank 11 via the undiluted etchant inlet pipe 16. (See page 11, lines 5-9.)

The etching apparatus also includes a second tank 13 that receives the residual etchant from the etch bath 20 via a connecting passage 23. (See page 16, lines 1-3.) The second tank 13 separates the diluted etchant from the residue material using of the residue material, and the second tank 13 then directly transfers the separated diluted etchant back to the first tank 12 via connecting pipe 17. (See page 11, lines 1-9.) An outlet pipe 18 is attached to the second tank 13 to discharge residual material. (See page 11, lines 7-9, Fig. 1.)

The etching apparatus also includes a control unit CPU to control the operation of the etch bath 20, the rinse bath 30, the dry bath 40, the first tank 12, and the second tank 13. Temperature may be used to determine the amount that the substrate has been etched, and hence the final thickness of the substrate. The temperature of the etchant indicates the total reaction energy of the etching reaction that indicates the amount of the substrate removed. A temperature sensor 60 in the etch bath 20 senses the temperature of the etchant and communicates this temperature to the control unit. For example, when the etchant reaches a predetermined temperature corresponding to a desire substrate thickness, the control unit transmits an etching termination signal to the etch bath. (See page 15, 1-10.)

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The Examiner rejected claims 1, 2, 7, 10, 11, 13, 14, 17-22, 25 and 26 under 35 U.S.C. §103(a) as allegedly being unpatentable over U.S. Patent No. 3,532,568 to Schutt ("Schutt"), in view of U.S. Patent No. 5,000,795 to Chung et al. ("Chung"), U.S. Patent 4,338,157 to Kanda ("Kanda"), and U.S. Patent No. 5,560,838 to Allies et al. ("Allies"). Further, the Examiner rejected claims 3-6, 8, 9, 12, 15, 23 and 24 under 35 U.S.C. §103(a) as allegedly being unpatentable over Schutt in view of Chung, Kanda and Allies, further in view of U.S. Patent No. 3,869,313 to Jones et al. ("Jones"). Finally, the Examiner rejects claim 16 under 35 U.S.C. §103(a) as allegedly being unpatentable over Schutt in view of Chung, Kanda, and Allies, further in view of U.S. Patent No. 4,886,590 to Tittle ("Tittle").

VII. ARGUMENT

A. The Examiner improperly rejected claims 1, 2, 7, 10, 11, 13, 14, 17-22, 25 and 26 under 35 U.S.C. § 103(a) as being unpatentable over Schutt in view of Chung, Kanda, and Allies.

Applicants wish to bring to the Board's attention a bit of the history of this case. A first Final Office Action was mailed in April 5, 2005 rejecting all of the claims. A Notice of Appeal was filed on July 6, 2005, and on January 6, 2005 an Appeal Brief ("prior Appeal Brief") was filed. On March 24, 2006, in response to the prior Appeal Brief, a Non-final Office Action was mailed. This Non-final Office Action states that prosecution is reopened and that a new ground of rejection is set forth in the Non-final Office Action. Upon careful review of the Non-final Office Action, it is noted that the rejection of claims 1, 2, 7, 10, 11, 14, 17-22, 25, and 26 is nearly identical to the rejection of these claims in first Final Rejection mailed April 8, 2005. The differences relate to replacing the previous primary reference Nelson with a new primary reference Schutt. So specific references to Nelson and elements in Nelson have been simply changed to specific references to Schutt and elements in Schutt. Some additional language, totaling about two sentences, in the previous Final Rejection was also removed from the present rejection. So it would seem to the applicants, that if the arguments in the Appeal Brief overcame the previous rejection, how simply swapping primary references and making the same exact arguments changes anything. Applicants respectfully assert that if the previous arguments overcame Nelson and the other art cited, that the same arguments overcome Schutt as currently cited and the other art cited. The Examiner has not provided a substantively new argument, hence the currently pending claims are allowable over Schutt and the other cited art.

In response to this argument the Examiner stated:

> Applicant states that his prior arguments under a now un-applied reference to Nelson remain effective and applicable. The Examiner disagrees. In particular, the "appearance" of the Examiner's rejection remains consisten from the final action because, for example, the claimed invention has not changes significantly or at all. As a result, Applicant's prior arguments based upon the now un-applied reference to Nelson are moot.

Applicants wish to simply point out that as Schutt has replaced Nelson in the rejection and the language of the rejection is nearly identical that Schutt has the same flaws as Nelson as applied in the rejection. Further, the arguments put forth in the prior Appeal Brief regarding Nelson

were persuasive enough to result in the Examiner issuing a Non-final Office Action. As a result, it would seem that the same arguments as previously put forth would overcome Schutt in combination with the other cited references as the Examiner has not identified how Schutt specifically teaches aspects of the present invention in a way that Nelson did not.

In order to support a rejection under 35 U.S.C. §103(a), the Action must establish a *prima facie* case of obviousness. To establish a *prima facie* case of obviousness three criteria must be met. First, there must be some motivation or suggestion to combine the applied references. Second, there must be a reasonable expectation of success. Finally, the combination must teach each and every claimed element. In the present case, claims 1, 2, 7, 10, 11, 13, 14, 17-22, 25 and 26 are not rendered unpatentable over the combination of Schutt, Chung, Kanda, and Allies because the Examiner fails to establish a *prima facie* case of obviousness as discussed below.

Independent claim 1 defines an etching apparatus for etching a glass substrate. The apparatus includes, *inter alia*, "a first tank including a first etchant," "an etch bath having a bubble plate, the glass substrate immersed in the first etchant and the etch bath connected to the first tank and receiving the first etchant, the etch bath containing a residual etchant including a diluted etchant and residue material after the glass substrate is etched with the first etchant, wherein a thickness of the glass substrate is uniformly reduced," and "a control unit controlling the first tank, the etch bath and the second tank, the control unit terminating the etching when a temperature of the first etchant reaches a termination temperature."

In rejecting claim 1, the Examiner asserts that Schutt discloses all of the claimed elements except an etch bath including a bubble plate and etching a glass substrate by immersion therein. The Examiner cites Schutt as "chemically etching ("etching zone 1"; Sole figure) material from a substrate (copper, abstract)." So Schutt does not teach a an etch bath that etches a glass substrate to uniformly reduce the thickness of the glass substrate. Rather, Schutt is directed to etching copper from off of a substrate, specifically a printed circuit board. Such a process is typically intended to form conductive patterns on the printed circuit board. Hence, etching a material uniformly to reduce its thickness is completely counter to the goal of Schutt. Accordingly, Schutt and the other cited references fail to teach every feature of the claimed invention.

The Examiner asserts that it would have been obvious to one skilled in the art to replace the etching zone 1 of Schutt with the wafer tank and bubble plate of Chung. This assertion is unfounded for the following reasons. The Examiner asserts that the motivation to replace the etchant delivery means with the a wafer cleaning tank including a bubble plate "would be to replace the etchant delivery means with an alternate and equivalent etching means," however the Examiner fails to provide any evidence of the desirability of combining Schutt with Chung. Schutt is actually silent as to the specifics of the etching zone, because Schutt is actually directed to an etching solution having a ferrous ion for etching copper. Further, Chung is directed to a semiconductor wafer cleaning method and apparatus. The cleaning of Chung is a very different process from the etching of Schutt. Etching is a process of removing a specific material from a surface either in specific areas or in specific amounts. Cleaning is the removal of all undesired impurities, residues, etc. from a surface. As discussed in §2143.01 of the MPEP, "[t]he mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination." *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Nowhere in the prior art is there any suggestion of the desirability of replacing the etching zone 1 of Schutt with a bubble plate and tank of Chung. Furthermore, the Examiner asserts that the bubble plate is an alternative and equivalent etching means to the etchant delivery means, however, the Examiner fails to address the fact the bubble plate requires a gas supply which is not disclosed in Schutt. Accordingly, a significant redesign of the system of Schutt would be required in order to accommodate a bubble plate (i.e., the mere replacement of the etching zone with a etch bath is not possible). Further, Schutt is directed to etching copper and more specifically an etching solution to etch copper, and Chung is directed to cleaning semiconductor wafers. These two are directed to completely different problems and fields. Therefore, absent proper motivation to modify the system of Schutt, the rejection of claims 1, 2, 7, 10, 11, 13, 14, 17-22, 25 and 26 is improper.

Kanda and Allies are cited as disclosing control systems for etching apparatuses. They do not disclose or suggest apparatus for etching a glass substrate that includes a first tank, an etch bath and a second tank as claimed.

In the Examiners Response to Arguments, he states that "etch bath" is not a structural limitation. Applicants disagree. A bath is clearly a structure that holds a liquid. An etch bath happens to be a bath the holds an etching solution. Further, the Examiner states that Chung is in

the field of applicant's endeavor -- wafer processing. While it is true that Chung is in the field of wafer processing, the present invention relates to etching a glass substrate such as that used in a liquid crystal display and not to wafer processing.

Because Schutt, Chung, Kanda and Allies each fail to disclose or suggest an etching apparatus for etching a glass substrate that includes a first tank, an etch bath and a second tank as claimed, the combination of these four references cannot possibly disclose or suggest said features. Therefore, even if one skilled in the art were motivated to combine Schutt, Chung, Kanda and Allies, the combination would still fail to render claim 1 unpatentable for at least the reason that the combination fails to disclose each and every claimed element.

Independent claims 11, 21 and 26 each define an etching apparatus for etching a glass substrate with an etchant that includes, *inter alia*, a first tank, an etch bath, and a second/separation tank which are substantially the same as those recited in claim 1. Therefore, claims 11, 21 and 26 are patentably distinguishable over the combination of Schutt, Chung, Kanda, and Allies for at least those reasons presented above with respect to claim 1.

In addition, claims 2, 7, 13, 14, 17-19, and 25 variously depend from independent claims 1 and 11. Therefore, claims 2, 7, 13, 14, 17-19, and 25 are patentably distinguishable over the combination of Schutt, Chung, Kanda, and Allies for at least those reasons presented above with respect to claim 1.

Independent claim 10 defines an etching apparatus for etching a glass substrate with an etchant. The apparatus includes, *inter alia*, an etch bath receiving the substrate immersed into the etchant, the etch bath etching the glass substrate, wherein the thickness of the glass substrate is uniformly reduced; a temperature sensor installed in the etch bath, the temperature sensor measuring and monitoring a temperature of the etchant; and a control unit controlling the etch bath, the control unit connected to the temperature sensor for receiving a signal indicating a temperature of the etchant to terminate the etching when the temperature of the etchant reaches a termination temperature.

In rejecting claim 10, the Examiner asserts that Kanda discloses a process control system having a thermocouple for measuring the temperature of the etching solution used to etch a submerged substrate. In addition, the Examiner asserts that one skilled in the art would have been motivated to control the etching operation for the etching apparatus of Schutt and Chung with the chemical processing control system of Kanda and Allies in order to detect the

termination of etching appropriately and precisely as taught by Kanda by an alternate and equivalent means of detecting said termination in using "reaction energy". These assertions are unfounded for the following reasons.

First, as discussed above with respect to claim 1, the Examiner fails to provide proper motivation of modify the system of Schutt to include an etch bath. Furthermore, nowhere in Schutt is there any suggestion of the desirability of controlling the etching process based on the temperature of the etchant, because Schutt is directed to an etching solution. Accordingly, absent proper motivation to modify the system of the Schutt, the rejection of claim 10 is improper.

Furthermore, even if, *arguendo*, one skilled in the art were motivated to combine Schutt, Chung, Kanda and Allies as suggested by the Examiner, the combination would still fail to render claim 10 unpatentable because the combination fails to disclose each and every claimed element.

Kanda discloses controlling the etching process based on the thickness of the substrate, which is calculated based on the speed of the etching process, which in turn is based on the temperature of the etchant. The mere fact that Kanda discloses measuring the temperature of the etchant solution is not equivalent to terminating the etching process when the temperature reaches a termination temperature. Nowhere in Kanda is there any disclosure or suggestion of determining a termination temperature, much less terminating the etching process once the termination temperature has been reached.

Because Schutt, Chung, Kanda and Allies each fail to disclose or suggest an etching apparatus that includes a temperature sensor and a control unit for terminating the etching process when the temperature of the etchant reaches a termination temperature, the combination of these four references cannot possibly disclose or suggest this feature. Therefore, even if one skilled in the art were motivated to combine Schutt, Chung, Kanda and Allies the combination would still fail to render claim 10 unpatentable because the combination fails to disclose each and every claimed element.

Independent claim 22 defines an etching apparatus for etching a glass substrate that includes, *inter alia*, a temperature sensor and control unit substantially as recited in claim 10. Furthermore, claim 20 depends from independent claim 10. Accordingly, claims 20 and 22 are

patentable distinguishable over the combination of Schutt, Chung, Kanda and Allies for at least those reasons presented above with respect to claim 10.

For at least those reasons present above, Applicant respectfully requests reconsideration and withdrawal of the rejection of claims 1, 2, 7, 10, 11, 13, 14, 17-22, 25 and 26 under 35 U.S.C. §103(a).

B. The Examiner improperly rejected claims 3-6, 8, 9, 12, 15, 23 and 24 under 35 U.S.C. § 103(a) as being unpatentable over Schutt in view of Chung, Kanda, and Allies, further in view of Jones.

Claims 3-6, 8, 9, 12 and 15 variously depend from independent claims 1 and 11. Therefore, claims 3-6, 8, 9, 12 and 15 are patentably distinguishable over the combination of Schutt, Chung, Kanda and Allies for at least those reasons presented above with respect to claims 1 and 11. In addition, independent claim 23 and claim 24 which depends therefrom, define an etching apparatus that includes, *inter alia*, a first tank, an etch bath and a second/separation tank as recited in claims 1 and 11. Therefore, claims 23 and 24 are patentably distinguishable over the combination of Schutt, Chung, Kanda and Allies for at least those reasons presented above with respect to claims 1 and 11.

Jones discloses an apparatus for automatic chemical processing of semi-conductors. However Jones fails to over come the deficiencies of Schutt, Chung, Kanda and Allies. Because Schutt, Chung, Kanda, Allies and Jones each fail to disclose or suggest an etching apparatus for etching a glass substrate that includes a first tank, an etch bath, and a second/separation tank as claimed, the combination of these five references cannot possibly disclose or suggest said features. Therefore, even if one skilled in the art were motivated to combine Schutt, Chung, Kanda, Allies, and Jones, the combination would still fail to render claims 3-6, 8, 9, 12, 15, 23 and 24 unpatentable for at least the reason that the combination fails to disclose each and every claimed element.

C. The Examiner improperly rejected claim 16 under 35 U.S.C. § 103(a) as being unpatentable over Schutt in view of Chung, Kanda, and Allies, further in view of Tittle.

Claim 16 depends from independent claim 11. Therefore, claim 16 is patentably distinguishable over the combination of Schutt, Chung, Kanda and Allies for at least those

reasons presented above with respect to claim 11. Tittle discloses a chemical process control system. However, Tittle fails to overcome the deficiencies of Schutt, Chung, Kanda, and Allies.

Because Schutt, Chung, Kanda, Allies and Tittle each fail to disclose or suggest an etching apparatus for etching a glass substrate that includes a first tank, an etch bath, and a separation tank as claimed, the combination of these five references cannot possibly disclose or suggest said features. Therefore, even if one skilled in the art were motivated to combine Schutt, Chung, Kanda, Allies, and Tittle, the combination would still fail to render claim 16 unpatentable for at least the reason that the combination fails to disclose each and every claimed element. Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection of claim 16 under 35 U.S.C. §103(a).

A copy of the claims involved in the present appeal is attached hereto as the Claims Appendix.

If these papers are not considered timely filed by the Patent and Trademark Office, then a petition is hereby made under 37 C.F.R. § 1.136, and any additional fees required under 37 C.F.R. § 1.136 for any necessary extension of time, or any other fees required to complete the filing of this response, may be charged to Deposit Account No. 50-0911. Please credit any overpayment to deposit Account No. 50-0911. A duplicate copy of this sheet is enclosed.

Dated: **2 September 2008**

Respectfully submitted,

By: _____

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CLAIMS APPENDIX

Claims Involved In The Appeal Of Application Serial No. 09/039,438:

1. (Previously Presented) An etching apparatus for etching a glass substrate comprising:

a first tank including a first etchant;

an etch bath having a bubble plate, the glass substrate immersed in the first etchant and the etch bath connected to the first tank and receiving the first etchant, the etch bath containing a residual etchant including a diluted etchant and residue material after the glass substrate is etched with the first etchant, wherein a thickness of the glass substrate is uniformly reduced;

a second tank receiving the residual etchant from the etch bath and separating the diluted etchant from the residue material;

a connecting passage directly connecting the first and second tanks and directly transferring the separated diluted etchant from the second tank to the first tank;

an outlet pipe attached to the second tank, the outlet pipe discharging the residue material; and

a control unit controlling the first tank, the etch bath and the second tank, the control unit terminating the etching when a temperature of the first etchant reaches a termination temperature.

2. (Previously Presented) The etching apparatus according to claim 1, wherein the etch bath includes a temperature sensor for sensing a target temperature to stop etching the glass substrate.

3. (Original) The etching apparatus according to claim 1, further comprising:

a rinse bath for cleaning the substrate that is etched in the etch bath; and

a dry bath for drying the substrate that is rinsed at the rinse bath.

4. (Original) The etching apparatus according to claim 1, further comprising:
an etching solution source for supplying an etching solution to the first tank; and
a water supply for supplying water to the first tank.

5. (Previously Presented) The etching apparatus according to claim 4, wherein the first tank includes a first amount of the first etchant of a concentration from the etching solution, a second amount of the water, and a third amount of the diluted etchant.

6. (Original) The etching apparatus according to claim 4, wherein the etching solution includes HF solution.

7. (Original) The etching apparatus according to claim 1, wherein the first tank includes a concentration measuring device measuring a concentration of a resultant etchant.

8. (Original) The etching apparatus according to claim 1, further comprising a pump connected to the connection passage for pumping the diluted etchant from the second tank to the first tank.

9. (Previously Presented) The etching apparatus according to claim 1, wherein the outlet pipe is connected to a bottom of the second tank, and the bottom portion of the second tank has a cone shape.

10. (Previously Presented) An etching apparatus for etching a glass substrate with an etchant, comprising:

an etch bath receiving the substrate immersed into the etchant, the etch bath etching the glass substrate, wherein thickness of the glass substrate is uniformly reduced;

a temperature sensor installed in the etch bath, the temperature sensor measuring and monitoring a temperature of the etchant while the glass substrate is etched in the etch bath; and

a control unit controlling the etch bath, the control unit connected to the temperature sensor for receiving a signal indicating a temperature of the etchant to terminate the etching when the temperature of the etchant reaches a termination temperature.

11. (Currently Amended) An etching apparatus for etching a glass substrate comprising:

a first tank including a first etchant;

an etch bath having a bubble plate, the glass substrate immersed in the first etchant and the etch bath connected to the first tank receiving the first etchant and etching the substrate with

the first etchant wherein a thickness of the glass substrate is uniformly reduced, the etch bath producing a residual etchant including a diluted etchant and residue material as a result of etching the substrate;

a separation tank receiving the residual etchant from the etch bath and separating the diluted etchant from the residue material using the weight [[gravity]] of the residue material, the separation tank directly transferring the separated diluted etchant to the first tank;

a rinse bath cleaning the glass substrate that is etched in the etch bath;

a dry bath drying the glass substrate that is rinsed at the rinse bath;

a solvent supply source supplying solvent water to the first tank;

an etching solution source supplying an etching solution to the first tank; and

a control unit controlling the etch bath, the rinse bath, the dry bath, the first tank, and the separation tank;

wherein an etched thickness of the glass substrate is derived from the temperature of the first etchant, and wherein the total reaction energy is used as a reference.

12. (Original) An etching apparatus according to claim 11, wherein the control unit controls the etch bath, the rinse bath, the dry bath, the first tank, and the separation tank such that each of the etch bath, the rinse bath, and the dry bath operates a corresponding process with respect to a plurality of substrates at substantially the same time.

13. (Previously Presented) The etching apparatus according to claim 11, further comprising a temperature sensor installed in the etch bath for monitoring a temperature of the first etchant while the substrate is etched in the etch bath, wherein the control unit receives signals indicating the temperature of the etchant from the temperature sensor and transmitting an etching termination signal to the etch bath when the temperature reaches a target temperature to terminate the etching of the substrate.

14. (Previously Presented) The etching apparatus according to claim 13, wherein the control unit receives signals indicating the temperature of the etchant at start of etching the glass substrate in the etch bath and processes the signals to derive the target temperature of the etchant.

15. (Previously Presented) The etching apparatus according to claim 11, wherein the first tank contains the first etchant from a mixture of the etching solution, the solvent water, and the diluted etchant.

16. (Original) The etching apparatus according to claim 11, further including a concentration measuring device installed in the first tank for measuring a concentration of the first etchant.

17. (Original) The etching apparatus according to claim 11, wherein the etching solution includes HF solution.

18. (Original) The etching apparatus according to claim 11, further comprising a discharging pipe connected to the first tank, the etch bath, the separation tank, and the rinse bath.

19. (Previously Presented) The etching apparatus according to claim 1, wherein the bubble plate is located at a bottom portion of the etch bath and produces nitrogen bubbles.

20. (Previously Presented) The etching apparatus according to claim 10, wherein the etch bath includes a bubble plate producing nitrogen bubbles from a bottom portion of the etch bath.

21. (Previously Presented) An etching apparatus for etching a glass substrate comprising:

a first tank including a first etchant;

an etch bath, the etch bath having a bubble plate generating nitrogen bubbles, the glass substrate immersed in the first etchant and the bubble plate connected to a nitrogen inlet pipe, the nitrogen inlet pipe connected to a nitrogen supply line, the etch bath connected to the first tank and receiving the first etchant, the etch bath containing a residual etchant including a diluted etchant and residue material after the glass substrate is etched with the first etchant, wherein a thickness of the glass substrate is uniformly reduced;

a second tank receiving the residual etchant from the etch bath and separating the diluted etchant from the residue material;

a connecting passage connecting the first and second tanks directly transferring the separated diluted etchant from the second tank to the first tank;

an outlet pipe attached to the second tank discharging the residue material; and

a control unit controlling the first tank, the etch bath and the second tank, the control unit terminating the etching when a temperature of the first etchant reaches a termination temperature.

22. (Previously Presented) An etching apparatus for etching a glass substrate with an etchant, comprising:

an etch bath receiving the glass substrate immersed into the etchant etching the glass substrate, wherein a thickness of the glass substrate is uniformly reduced;

a temperature sensor installed in the etch bath measuring and monitoring a temperature of the etchant while the glass substrate is etched in the etch bath; and

a control unit controlling the etch bath, the control unit connected to the temperature sensor for receiving a signal indicating a temperature of the first etchant to terminate the etching when the temperature of the first etchant reaches a termination temperature, wherein the temperature of the first etchant varies in accordance with a reaction heat generated from etching the glass substrate, and the termination temperature of the first etchant depends on total reaction energy.

23. (Currently Amended) An etching apparatus for etching a glass substrate comprising:

a first tank including a first etchant;

an etch bath having a bubble plate generating nitrogen bubbles, the glass substrate immersed in the first etchant and the bubble plate connected to a first nitrogen inlet pipe, the nitrogen inlet pipe connected to a nitrogen supply line, the etch bath connected to the first tank receiving the first etchant and etching the substrate with the first etchant, wherein a thickness of the glass substrate is uniformly reduced, the etch both producing a residual etchant including a diluted etchant and residue material as a result of etching the substrate;

a separation tank receiving the residual etchant from the etch bath separating the diluted etchant from the residue material using the weight [[gravity]] of the residue material, the separation tank directly connected to the etch bath via an etchant outlet pipe, the separation tank directly transferring the separated diluted etchant to the first tank;

a rinse bath cleaning the glass substrate that is etched in the etch bath;

a dry bath drying the glass substrate that is rinsed at the rinse bath;

a solvent supply source supplying solvent water to the first tank;

an etching solution source supplying an etching solution to the first tank; and

a control unit controlling the etch bath, the rinse bath, the dry bath, the first tank, and the separation tank;

wherein an etched thickness of the glass substrate is derived from the temperature of the first etchant, and wherein the total reaction energy is used as a reference.

24. (Previously Presented) The etching apparatus according to claim 23, further comprising a heater for supplying heat is installed at a side of the dry bath.

25. (Previously Presented) The etching apparatus according to claim 11, further comprising a temperature sensor installed in the etch bath for monitoring a temperature of the first etchant while the substrate is etched in the etch bath, wherein the control unit receives signals indicating the temperature of the etchant from the temperature sensor and transmitting an etching termination signal to the etch bath when the temperature reaches a predetermined target temperature to terminate the etching of the glass substrate, and wherein a reaction heat generated from etching the glass substrate changes the temperature of the etchant.

26. (Previously Presented) An etching apparatus for etching a glass substrate comprising:

a first tank including a first etchant;

an etch bath connected to the first tank and receiving the first etchant, the etch bath containing a residual etchant including a diluted etchant and residue material after the glass substrate is etched with the first etchant;

a second tank receiving the residual etchant from the etch bath and separating the diluted etchant from the residue material using gravity of the residue material;

a connecting passage connecting the first and second tanks for transferring the separated diluted etchant from the second tank to the first tank;

an outlet pipe attached to the second tank, the outlet pipe discharging the residue material;

a temperature sensor sensing a temperature of the first etchant; and

a control unit receiving a signal indicating the temperature of the first etchant from the temperature sensor and transmitting an etching termination signal to the etch bath.

EVIDENCE APPENDIX

Evidence:

None.

RELATED PROCEEDING APPENDIX

Related Proceedings:

None.